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(54) Device for securing a cylinder drive gear to a shaft

(57) A structure for securing a cylinder drive gear to a cylinder shaft of a printing machine comprises a cylinder (12) having an end shaft (12a), a cylinder drive gear (16) inserted and fixed by bolts (18) onto said end shaft, a pair of taper rings (23, 24) with their tapered faces being in contact with each other, one of said taper rings (23) being mounted on said end shaft such that movement in the axial direction is limited by said cylinder drive gear, the other taper ring (24) being mounted slideably on said end shaft (12a), and a device (21, 22) for tightening said other taper ring toward said cylinder drive gear so that both taper rings expand in the radial direction to form a firm clamp between the periphery of the shaft (12a) and the encircling surface (16f) of the drive gear.

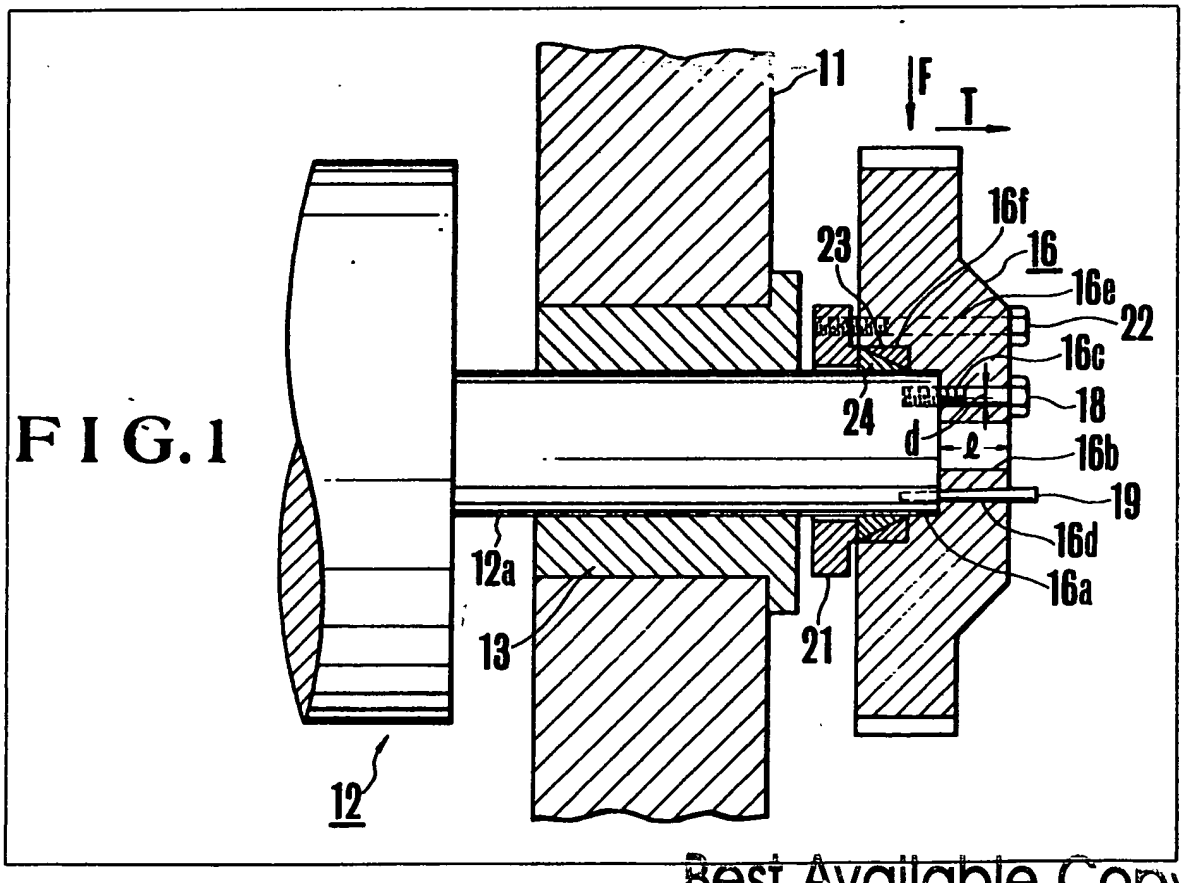

FIG.1

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FIG.1

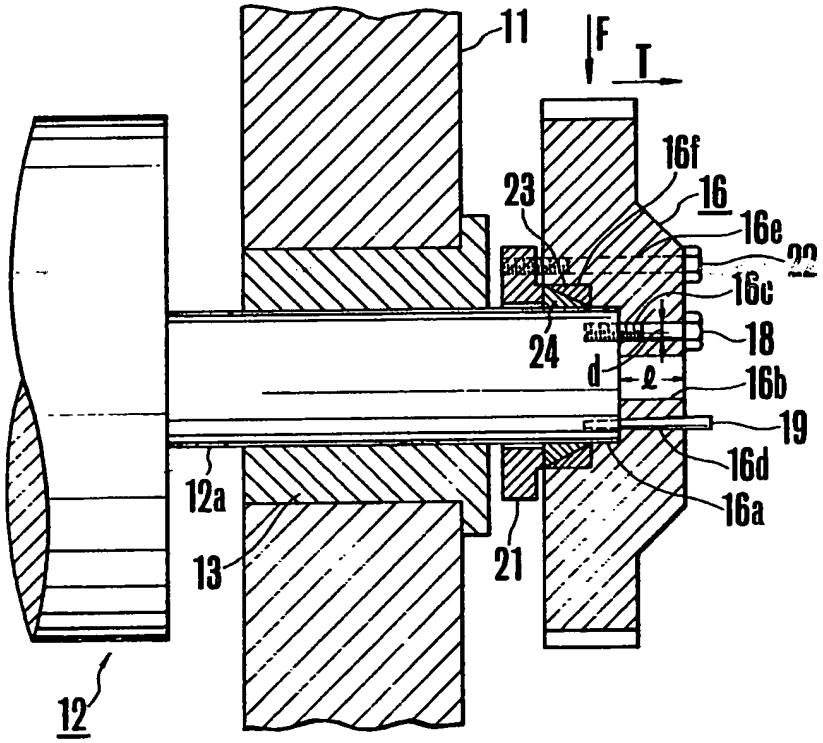

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FIG.2

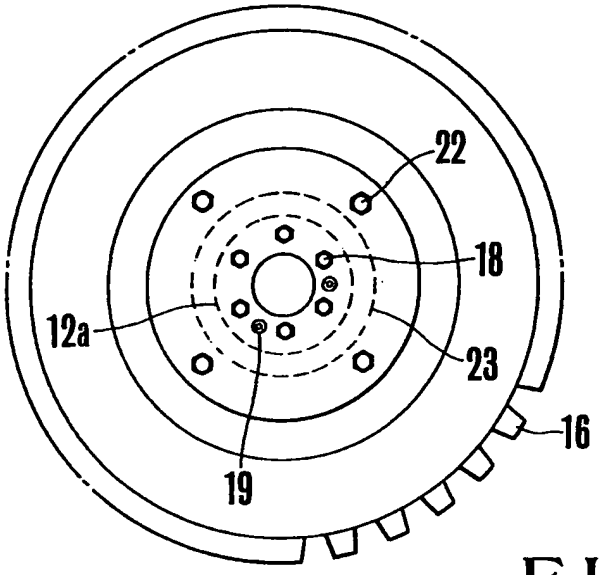
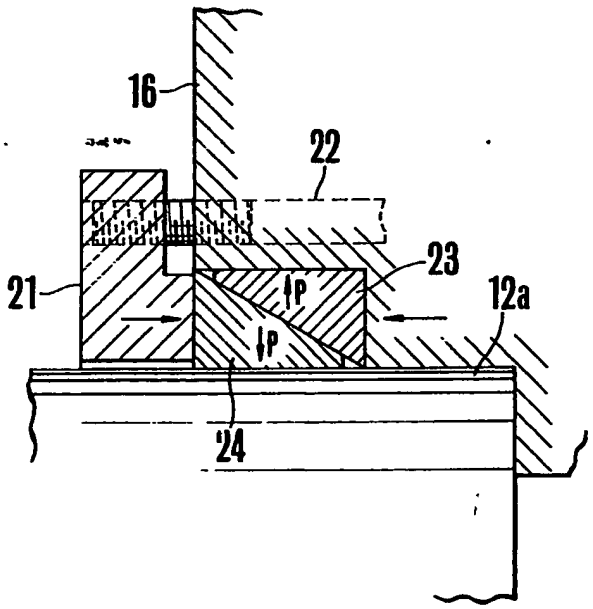


FIG.3



SPECIFICATION

Structure for securing a cylinder drive gear to the end of a cylinder shaft in a printing machine

The present invention relates to a structure for securing a cylinder drive gear to the end of a cylinder shaft in a mechanism for driving a plate cylinder or the like of a printing machine or press.

A general rotary printing press has plate cylinders or blanket cylinders with their shafts supported by the frame at both their ends, and on at least one end of each shaft there is secured a cylinder drive gear which links the cylinder to the adjacent cylinders and also to the drive mechanism. Various structures are known for securing a cylinder drive gear to the end of a cylinder shaft. In a typical example, the end of the shaft and the cylinder drive gear are tapered so that the shaft fits in the gear, and the drive gear on the tapered portion of the shaft is pressed toward the cylinder by tightening a nut on a thread which is cut on the end portion of the shaft, so that slip in the circumferential direction can be prevented by friction and also by use of a key provided between them. In another example, the cylinder drive gear is secured to the end of the cylinder shaft with a key provided at the contact portion thereof so that slip in the circumferential direction is prevented, and also shift of the gear in the axial direction is limited by employing a holding plate which is fixed to the end of the shaft by a bolt. These structures are disclosed in, for example, "Oyo Kikai Kogaku" Pages 124 to 127 Vol. 17, No. 6, 1976, published by K. K. Taiga Shuppan in Japan.

However, the foregoing conventional structures for securing a cylinder drive gear to a cylinder shaft have the following disadvantages. In the first mentioned prior art structure, it is difficult to machine the tapered portion and keyway accurately, resulting in a high machining cost, and also it can reduce the strength of the shaft due to the cut for the keyway and also cause eccentricity of the drive gear. In the second mentioned structure, in addition to a high machining cost and reduction of the strength owing to the machining for the keyway, the drive gear is liable to vibrate due to a poor fitting accuracy between the drive gear and the shaft, resulting in wear of the key and shaft that causes increased vibration. In order to avoid the vibration, the securing portion must be made long and the width of the frame which supports a long shaft cannot be made small.

As described above, conventional structures for securing a cylinder drive gear have disadvantages such that vibration of the gear and wear of the key and other components owing to the inertial torque when the machine stops, cannot be avoided. These problems can cause failure of printing, and improvement of such mechanism has long been desired.

Accordingly, the primary object of the present invention is to provide a structure for securing a cylinder drive gear to the end of a cylinder shaft in a printing machine or press, so as to prevent failure of printing caused by vibration of the drive gear.

In view of the aforementioned situation, the present invention provides a structure for securing a cylinder drive gear to a cylinder shaft in a printing machine, wherein a cylinder drive gear is fitted and clamped by bolts, to the end portion of a cylinder shaft and a pair of taper rings are provided at the securing portion for fitting the drive gear to the circumferential surface of the end of the shaft by sliding one of the taper rings so that the drive gear is fitted to the end of the shaft through an increased contact area, whereby failure of printing due to the vibration of the drive gear can be prevented.

An embodiment of the invention will now be described by way of example and with reference to the accompanying drawings, in which:—

Figure 1 is a cross-sectional view showing the structure according to the present invention for securing a cylinder drive gear to a cylinder shaft in a printing press; and

Figures 2 and 3 are a front view and cross-sectional view in part of the structure shown in Fig. 1, respectively.

Figs. 1–3 show a structure for securing a cylinder drive gear to a cylinder shaft embodying the present invention, in which an end shaft 12a of a cylinder 12 is supported rotatably by a frame 11 through a bearing 13. Although the structure of only one side of the cylinder 12 is shown, the other side of the cylinder is also provided with an end shaft supported identically by the frame through a bearing. The bearing is of a known type and it is illustrated briefly. In general, a unitary material. A cylinder drive gear 16 has a shaft hole having a large diameter section 16a and a small diameter section 16b, and it is secured to the end shaft 12a such that the large diameter section 16a fits to the end portion of the end shaft 12a. The drive gear 16 also has a plurality of through-holes 16c, 16d and 16e provided in respective equal intervals around the shaft hole. A plurality of bolts 18 are screwed from outside to the end face of the end shaft 12a through-holes 16c so that the drive gear 16 is coupled to the end of the shaft, and a plurality of taper pins are pegged into the end face of the shaft so as to prevent a slip between the drive gear 16 and the end shaft 12a in the circumferential direction. Between the drive gear 16 and the bearing 13 on the end shaft 12a, there is provided a pressing flange 21 formed in a disk shape slideably against the end shaft 12a, and it is

pulled toward the drive gear 16 by screwing a plurality of clamp bolts 22 provided on it from outside through the holes 16e of the gear 16.

The large diameter section 16a of the shaft hole in drive gear 16 is cut away at the side of pressing flange 21 to form an annular cut portion 16f, in which a pair of taper rings 23 and 24 mounted on the end shaft 12a are fitted. The taper rings 23 and 24 are formed to have a triangular cross-section, so that their machined taper faces are in contact with each other. One taper ring 23 is fitted to the cut portion 16f of the drive gear 16 and another taper ring 24 is slideably mounted on the end shaft 12a. The taper ring 24 is slideably shifted against the end face of slideable pressing ring 21 toward the end of the shaft, and it is deformed contractively by the action of its taper face so as to fit to the end shaft 12a, while another taper ting 23 is slightly deformed expansively so as to fit to the drive gear 16.

In mounting the drive gear 16 on the end shaft 12a of cylinder 12, taper rings 23 and 24 are first inserted into the cut portion of the drive gear, then the pressing ring 21 is mounted on the drive gear 16 by screwing the bolts 22 so that the taper rings 23 and 24 do not come out of the drive gear 16. The drive gear assembly is inserted onto the end portion of the end shaft 12a, the taper pins 19 are pegged for positioning, and the bolts 18 are screwed into the end face of end shaft 12a. Thus, cylinder drive gear 16 is fitted to the end face of the end shaft 12a.

After that, as the clamp bolts 22 are further screwed into the pressing ring 21, it is pulled toward the drive gear 16. Then, taper ring 24 is pushed by the pressing ring 21 toward the end of the shaft, causing expansive deformation of both taper rings 23 and 24 in the radial direction by the action of the taper faces, whereby the drive gear 16 and the end shaft 12a are pressed in the directions shown by arrow P in Fig. 3. Consequently, the cylinder drive gear 16 is tightly secured to the end shaft 12a with the taper rings 23 and 24 placed therebetween. The taper rings 23 and 24 are preferably arranged with their taper faces being oriented as shown in the drawings. The results of experiments shows that the strongest coupling between the end shaft 12a and the drive gear 16 is obtained by choosing the bolts 18 so that ratio l/d, where l is the through-length of the bolt 18 in drive gear 16 and d is the diameter of the bolt 18, is between 2.5 and 3.

Since a helical gear is generally used for drive gear 16, a radial force is applied to the drive gear as shown by arrow F in Fig. 1. Therefore, these taper rings 23 and 24 are preferably provided with their axial dimension being inclusive within the annular cut portion in the drive gear, so as to enhance the strength of coupling against the radial force. A thrust force is also applied to drive gear 16 as shown by arrow T in Fig. 1. However, this structure is very strong against the external thrust force, because drive gear 16 is in press contact with the end shaft 12 at both its end face and circumferential surface.

As can be seen from the above description, the present invention provides a structure for securing a cylinder drive gear to the end portion of a cylinder shaft in a rotary printing press and the like, wherein the drive gear is inserted and screwed by bolts onto the end portion of the shaft, and a pair of taper rings are mounted on the shaft, one being fixed to the securing section of the gear and the other being mounted on the shaft slideably, so that the drive gear is press-fitted to the shaft at the end face of the shaft and also at the circumferential surface of the shaft. A large contact area at the end face and circumferential surface of the shaft allows the drive gear to be secured tightly to the end of the cylinder shaft, and coupling is not loosened by the vibration and shock at stopping of the machine or by the external force through the drive gear. Consequently, the drive torque can be transmitted efficiently, and the shaft and the shaft hole in the drive gear are prevented from wearing which could cause vibration and eccentricity of the gear, thus every failure of printing can be prevented. Elimination of a key solves expensive machining cost, reduction of the strength of the shaft and eccentricity of the drive gear, and also facilitates mounting and demounting of the drive gear. Moreover, the circumferential surface of the shaft is effectively utilized for securing the drive gear, so that a large contact area can be obtained without elongating the shaft, whereby the end portion of the cylinder shaft can be made compact.

The present invention is not limited to the foregoing embodiment, but extensive applications and various modifications are possible within the scope of the invention as defined in the accompanying claims.

CLAIMS

1. A structure for securing a cylinder drive gear to an end shaft of a cylinder of a printing machine comprising:

a cylinder having an end shaft;

a cylinder drive gear for mounting onto said end shaft for securing thereto by bolts;

a pair of taper rings having complementary taper surfaces for contact with each other, the arrangement being such that one of said taper rings can be mounted on said end shaft such that movement in the axial direction of that ring is limited by said cylinder drive gear when mounted on said end shaft as aforesaid with the other taper ring being slideably mounted on said end shaft; and

a tightening device for moving said other taper ring toward said cylinder drive gear so

that both taper rings expand in the radial direction to form a frictional connection between the periphery of the end shaft and an encircling portion of the cylinder drive gear.

2. A structure according to claim 1, wherein said tightening device comprises a pressing ring for mounting slideably between said cylinder and said cylinder drive gear on said end shaft, and clamping bolts which can be screwed into said pressing ring through said cylinder drive gear to draw the pressing ring towards the cylinder drive gear thereby to effect said radial expansion of the taper rings.

3. A structure according to claim 2, wherein the l/d ratio of each said bolt is between 2.5 and 3, where l is the length of the respective aperture in the drive gear through which the bolt extends and d is the diameter of the bolt.

4. A structure according to any preceding claim, wherein said end shaft is further provided with at least one taper pin pegged therein through said cylinder drive gear.

5. A structure for securing a cylinder drive gear to a cylinder shaft of a printing machine, substantially as hereinbefore described with reference to, and as illustrated in the accompanying drawings.

6. A printing machine having a structure as claimed in any preceding claim.

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